



Pileup in a wire-based LArTPC DUNE ND

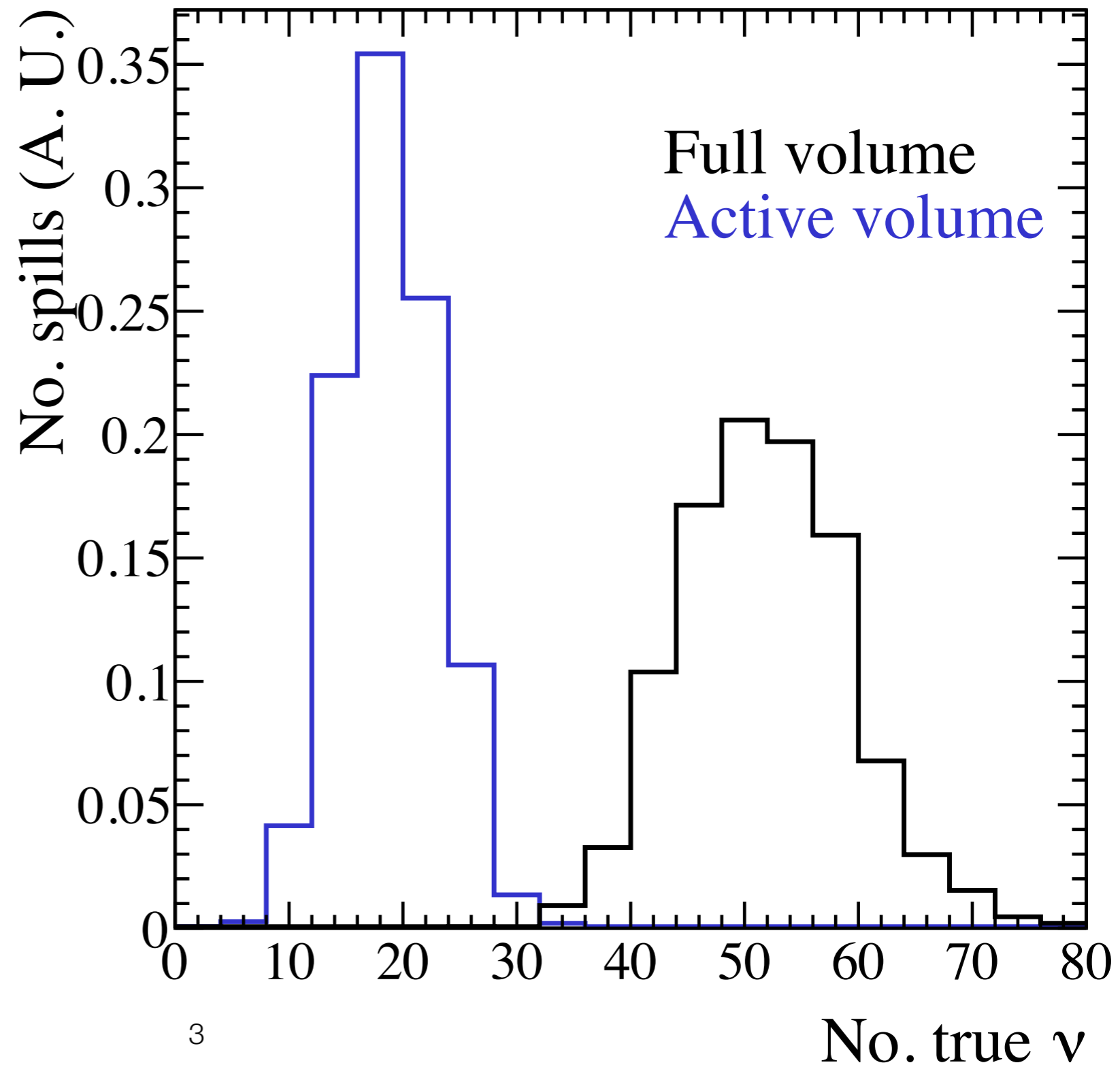
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DUNE ND alternatives meeting
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Sim/reco information

- Simulated GENIE interactions in an SBND-like detector + cryostat using the DUNE ND flux
 - Simulated full spill structure ($7.5e13$ POT/spill)
 - Separately simulated single interaction events
- Events are reconstructed using Pandora
 - Pandora reconstructs the full neutrino interaction
 - Pandora is capable of reconstructing multiple neutrinos per spill
- The aim of the study is to assess the quality of the reconstructed neutrinos with the expected high pileup from the DUNE ND flux

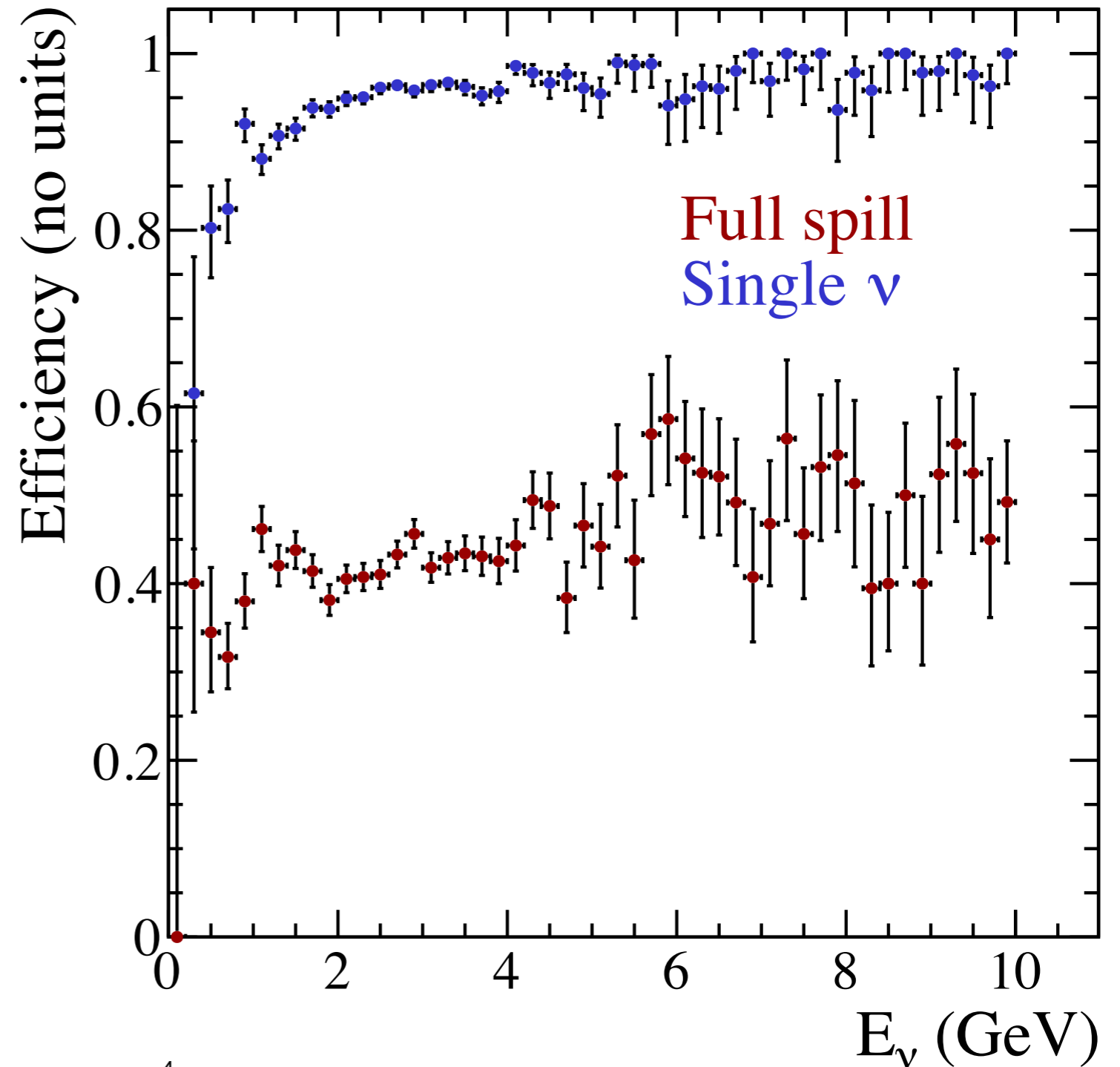
Number of true neutrinos

- Pileup is high
- Most likely number of interactions in the active volume is between 15 and 20



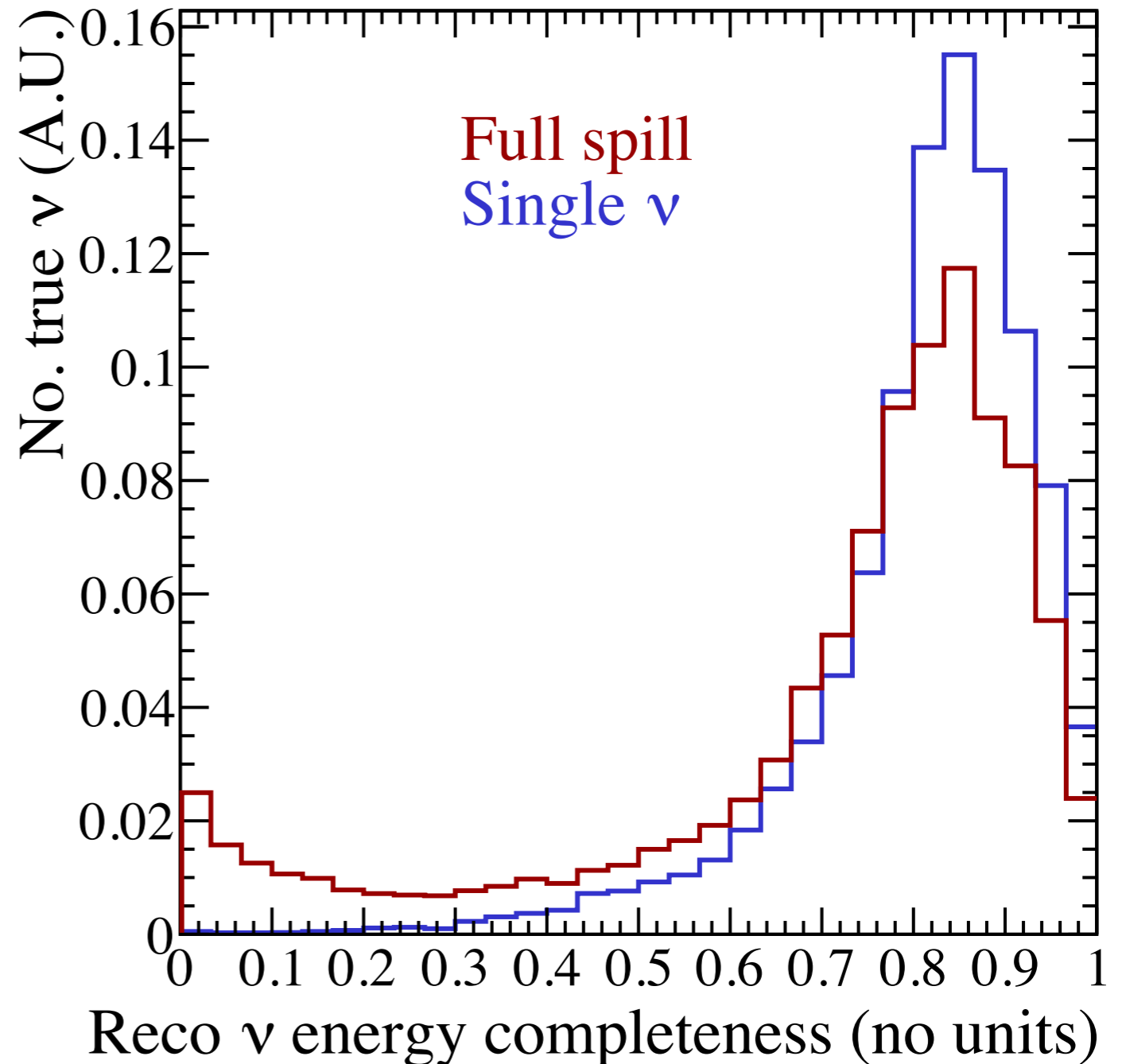
Neutrino reconstruction efficiency

- Reconstruction efficiency is low for full spills
- The definition of 'reconstructed' is:
 - A reconstructed neutrino that truth matches to a true neutrino
 - Only one true neutrino can 'own' a reconstructed neutrino



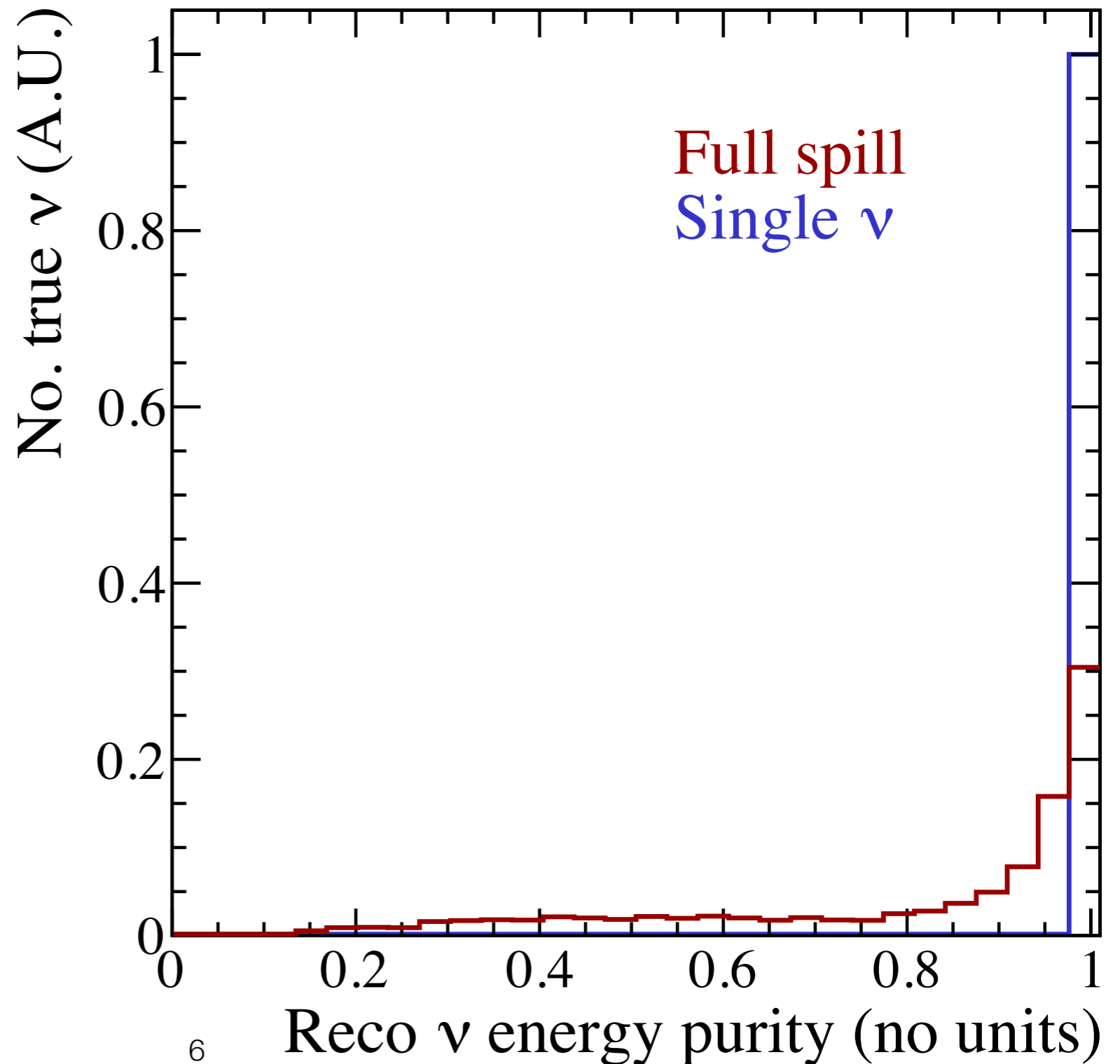
Reconstructed energy completeness

- Energy completeness: the fraction of true neutrino energy deposited in a detector that is contained in a reconstructed neutrino
- Low completeness peak for the full spill is a combination of truth matching mechanics and reconstruction segmentation
 - Some reconstructed neutrinos are a merged combination of two or more true neutrinos, but only one true neutrino can own the reconstructed cluster
 - Some true neutrinos are reconstructed as several reconstructed neutrinos



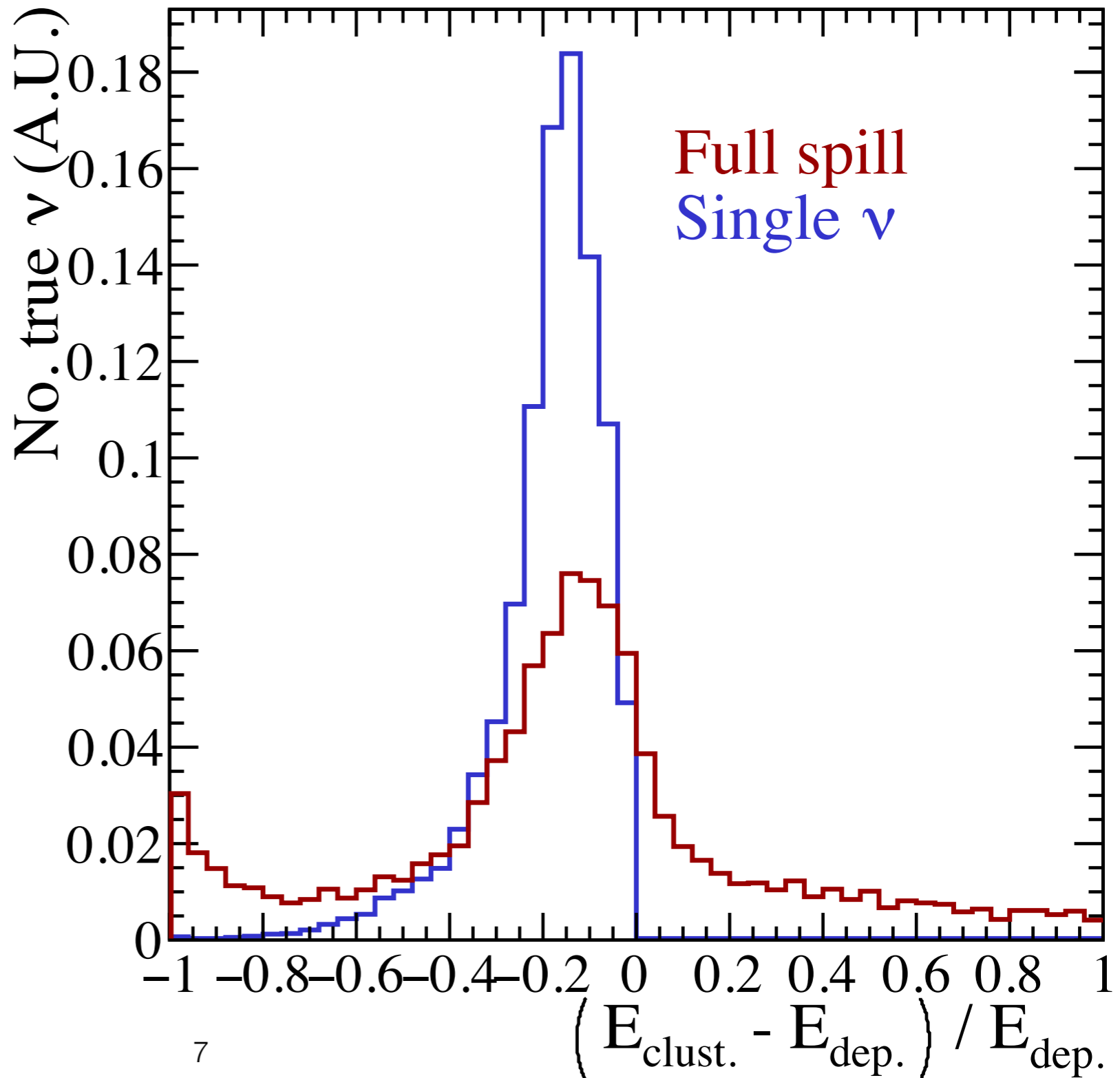
Reconstructed energy purity

- Energy purity: the fraction of true energy contained in a reconstructed neutrino that belongs to the dominating true neutrino
- Clear contamination from two or more true neutrinos being merged into a single reconstructed neutrino



Reconstructed energy separation

- E_{clust} : the total true energy contained in a reconstructed neutrino
- E_{dep} : the total energy deposited in the detector by a true neutrino
- For a single neutrino event, the distribution mimics the energy completeness distribution
- For full spill events, the impurity in the reconstructed clusters causes significant tails in the energy separation



Summary

- Simulated full spill events in an SBND-like detector using the DUNE flux
- The high pileup causes:
 - entire neutrinos to be missed
 - Impure reconstructed clusters for neutrinos that are reconstructed